SPEAKING NOTES
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AT

THE CHP SUMMIT: A NATIONAL DIALOGUE ON COMBINED HEAT AND POWER -- CLEAN ENERGY SOLUTION FOR A GROWING ECONOMY

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Ladies and gentlemen, thank you for the opportunity to speak to you today. I believe that today's CHP Summit should provide an important springboard for a change in direction in the way that we use energy effectively and efficiently – with reduced environmental impact. The impact of the broad application of CHP is so significant that it warrants the efforts of each and every one of us to support its broad implementation.

You have heard other speakers today, elaborate on what CHP is and how less energy is used – less CO2 produced – when combining the production of heat and power. I would like to explore the why's and how's of its implementation. I would like to challenge public and private sectors to more seriously explore cooperation. I would also like to comment on the necessary role of government in forging a linkage between public and private interests and in crafting "win-win" opportunities – in making CHP a reality.

CHP is a key technology for reducing greenhouse gas emissions, particularly CO_2, that contribute to climate change. In the event that you are skeptical about the linkage of greenhouse gas emissions and climate change, at least you should be interested in smart risk management.

Everyday activities such as using electricity, driving our cars and heating our homes and businesses require the consumption of fuels, which, when burned, release greenhouse gases, in particular CO_2, into the atmosphere. Each year, the world releases 5 to 5.5 billion tonnes of CO_2 by burning fossil fuels.

Some of the consequences of increased concentrations of greenhouse gases are already being felt worldwide. An analysis of temperature records shows that the Earth has warmed an average of 0.5° C over the past 100 years. Furthermore, over the last century, the highest temperatures on record have occurred since the mid-1980s (1983, 1987, 1988, 1989, 1990, 1991, 1994, 1995, 1996, and 1997), and they have been coupled with record extreme weather events. In Canada, such extreme events include:

1. the 1996 summer flooding in the Saguenay area (Quebec);
2. the 1997 spring flooding of the Red River (Manitoba); and
3. the 1998 ice storm that affected Central and Eastern Canada as well as the North Eastern United Stated States.

In the past year alone there are many signs, which are consistent with scientific models, that the climate is changing in the United States. Examples include:

1. this past Spring, in the States of California, Arizona, and Nevada the moist and mild winter spurred pest infestations;
2. Northern California registered the wettest month of May since keeping record B it received 800% of the average precipitation in some areas;
3. in June, there was a blistering heat wave in the State of Michigan -- electricity use soared forcing utilities to cut off factories (the Ford plant was shut down); and
4. in July, a deadly heat wave affected the City of Dallas which saw over 15 - 100 ° F days -- heat and drought damaged agriculture and caused $4.6 billion loss to the

Texas economy.

We should not forget the many international disasters including the flooding of the Yangtze River in China - possibly the largest disaster in recent history. Also, closer to home, hurricanes Mitch and George. Just on the news yesterday, I heard that this hurricane season has been the worst on record.

Catastrophic losses are becoming more severe, and more frequent. Before 1987, there had never been a natural disaster causing insured losses of more than $US 1 billion; however, during the last decade, there have been 18 such disasters. The Ice Storm 98 is the largest loss ever in Canada, northern New York and Maine. By value, it is one of the thirty largest losses ever recorded by the insurance industry.

While we are arguing about climate change science, the insurance business knows that something funny is going on! We need to lower our green house gas emissions. For that we need to use more renewable energy and to use energy much more efficiently.

Let's look at how we use energy now. In our energy planning, all of us are very comfortable with the concept of achieving high efficiency making sure that as much energy as possible that is consumed comes out of a process as useful product. However, we are not so comfortable with the concept of not squandering energy quality. We quite freely use clean natural gas to warm air to 70 F even though that same gas could have melted steel or powered a turbine or an automobile engine. Once we choose to burn a combustible energy source, it is capable of releasing high temperature energy which we have an opportunity to harness to best advantage before it is dissipated – and gone – forever. We must, if we are to reduce our fossil fuel use, use every unit of energy to perform the highest possible function then warm the air in our homes and offices from the by-products, the lower temperature rejects. Combined Heat and Power (CHP) allows us to do that.

There is enormous investment into increasing the efficiency of electricity generation alone. This is important as we want to get the most high value product from the fossil fuel burned. However, a 55% efficiency combined cycle gas turbine will still reject and waste 45% of the energy input. So we need to assure that all new electricity production has the potential to operate in a CHP mode and that it is located so as to be able to sell the heat.

Let's discuss the name CHP. I like it because it gives equal weight to the production of both <u>heat</u> and <u>power</u>. It discourages us from thinking of it as another technology component like a pump or an engine and it challenges us to look at the finding, assembling and managing of heat load and well as to the production and sale of electricity. While there are limits to the amount of heat that we can convert into work – or power – there is no reason that the rejected heat must be wasted. However, sizing designing and locating CHP units so as to squeeze the most out of the energy consumed takes planning and cooperation – and effective marketing. Not just to customers, but to the community leaders in which CHP is to flourish. Luckily, there is no shortage of

examples

Many other countries have recognized the important role of CHP. European Union estimates suggest that for each MWh of electricity produced by CHP will save about 500 kg of CO_2 in comparison to separate production of heat and electricity. In 1995, the European Commission committed to develop a strategy for the promotion and the dismantling of barriers to the wider deployment of CHP.

The Netherlands, Denmark, and Finland are of particular interest because they illustrate that sustained co-ordinated policy initiatives can be successful in overcoming the obstacles to growth in CHP and in providing a favourable framework for its implementation.

In Finland for example, fully 45% of all Finnish buildings are connected to community energy systems. Approximately 30 years of effort has been required to achieve the current penetration rates. Participation in community energy systems by building owners is voluntary and participation exceeds 90% in some communities.

In 1995, 76% of Finland=s industrial and domestic heating requirements and 30% of their electricity is produced from CHP plants. A recent estimate by the Finnish District Heating Association suggests that CHP saves 2.9 million tons of oil each year - approximately 20% of Finland=s annual fossil fuel consumption

In the UK, CHP installations are expected to reach 5000 MW by the year 2000 − more than double 1991 installed capacity.

In the United Kingdom, CHP technology is now in use in a large and growing number of locations. It is important to note that some of the more significant gains come from the development of CES which use CHP as their heat source.

In 1996, the CHP installed capacity represented just over 5% of the UK generating sector with some 6% of electricity being supplied by CHP (total capacity of 3,562 MWe). The use of CHP has helped to cut UK emissions of CO_2 by over 12 million tonnes in 1996 alone.

In the UK, CHP remains the most important single technology as far as potential energy saving measures are concerned. The Government's current CHP target is 5,000 MW by 2000. To achieve this target will require an installation rate of 270 MW of new CHP capacity, each year, for the period 1991-2000.

Why has the European Union made such a big commitment to CHP? It has been recognized that the full exploitation of CHP could provide about 40% of the total electricity production requirements and has the potential to reduce CO2 emissions by over 300 Mt per year − or about 9% of the European Union projected total of about 3,500 Mt in 2010.

So, others recognize the importance of CHP and are moving ahead well. Why can't we do the same in North America? I think we can.

Before continuing further, I would like to put CHP in context. While it may be an important part of a national strategy, it is first and foremost an integrated part of a community energy system. While electricity can be wheeled and transported across the country and national boundaries, the use of heat is more localized. Therefore, we have to appeal to local decision makers if we are to implement CHP as a national good. How do communities look at energy choices?

A community is an investor with a different set of investment criteria. A community wants to know:

How can we improve the local environment?
How can we be more self-reliant and keep money within the community?
Can we stabilize energy prices for residents and businesses alike?

Some may even ask:

Can we provide markets for local energy sources or materials?

So, if we want the community to want to direct attention, and possibly investment, into energy matters, we have to be able to provide good answers to these and related questions. While some energy projects can go ahead within a community without their taking a position, I have never seen a really major energy project move ahead without community endorsement and support. We, as we start to think big (and we must think big if we are to have big impact), are playing in the community's sandbox and if we are to be really successful, we have to understand the community's rules.

In my dealings with communities, I have found a checklist for sustainable energy use to be very effective in discussing energy options – both at local and global levels. This checklist helps put CHP in context as well as building bridges with other important community energy options. It goes like this:

If energy resources are being wasted and are causing pollution, use them to displace fossil fuel – a double benefit (e.g. landfill gas or wood waste);
If heat is being rejected from industries that they cannot use themselves, use it to displace fossil fuel (e.g. from steel or pulp and paper mills);
If renewable energy is available (e.g. wood chips from forests or crop residues) use them to displace fossil fuels;
If you use fossil fuel, use CHP to the maximum extent possible.

I think that this checklist makes good common sense from both environmental and local economic perspectives. It also places CHP in context with good allies in the Green Movement. However, the barrier to many of these options is either the access of users to the resource or achieving the economy of scale required to convert the resource into useful energy.

This is where it is appropriate to introduce the concept of the Community Energy System. I use this term to extend on the concept of district heating to a community-wide network that can be constructed to link sources of economical and environmentally desirable sources of energy to energy users – a community energy broker. It is a network, rather than a source. It facilitates others good things to happen.

Some of you may be asking why I am going on about the community so much? That is one of the special topics that I was asked to address here today. In Canada, like the United States, we have been lacking policies, programs or tax incentives that would make community energy networks more attractive as investments for the private sector. Furthermore, we need community energy networks to create large heat loads for CHP. To make things worse, with no market for community energy systems and CHP, there were not a lot of suppliers, engineers or marketing consultants with the complete skill set to develop projects. A classic "chicken or the egg" situation. Projects were not moving ahead.

After a period of years of investing in feasibility studies we kept coming up with project returns on investment (R.O.I.'s) that were below the private sectors expectation ***for the level of risk involved***. I should emphasize for the level of risk involved. We also did studies with the public sector, typically municipal utilities, and projects did not proceed as the municipality did not feel comfortable investing in energy when the public was expecting them to fix up the sewer and water systems and roads. Some projects proceeded, but not many. This was not going to be a major path to implementation. And policy makers were cautious. Who wants to make policy and programs if no one pays any attention. They too, have to choose where to invest time an effort so as to get good returns. So, we had to either drop community energy systems and CHP projects - or find another way.

To re-cap, we found communities interested, but unwilling to go it alone. We found the private sector keen but unwilling to proceed at the ROI's commonly available given the risk of getting customers, negotiating access to the electrical grid, getting right-of-ways etc. But, we knew that there was a "win-win" situation there somehow.

I am pleased to say that we now have many projects underway in all parts or the country and the basis of a model for a national program. Some elements of our approach are, I am sure, of interest to you.

First, we set up a team comprised of people with engineering, municipal policy, business and marketing backgrounds which had the full skill set to develop project – a team of public sector entrepreneurs whose sole goal was to get good environmentally sound

community energy system projects implemented. By trial and error, we developed a process that got projects on track.

First, there was the recognition that we must address equally technical, business and institutional or political issues. Like the three legs of a stool, you need all three and they have to be the same length or the stool − the project − falls over.

Second, we decided that we would not get involved in projects unless the municipality was involved as a key stakeholder. No consultant or privately driven projects unless the community was clearly part of the team. We then enter into a three-stage process:

If the community is seriously interested, then we, the CES group, get some key information (mapping and heat loads, local energy prices etc.) and do a preliminary analysis to see if the project has any potential. Also we identify any barriers that will have to be addressed if the project is to proceed. If the project looks good and if the commitment exists to address barriers, then we proceed to stage 2.

We ask the community or municipal utility to enter into an agreement for Stage 2 of the development process where the CES group takes responsibility for the project development, feasibility investigations etc. with the condition that the community pays 50% of the cost as we go. Furthermore, if the project is ultimately successful, then we will be paid back the other 50% upon project financing. This way, both parties have an interest in spending as little as possible and in shutting down the development process if success seems unlikely. Shared risk is essential to success. Freebees never worked. At this stage we are undertaking a pre-feasibility investigation. Not enough detail to make a final construction decision, but enough to give more comfort that we are on the right track and that ultimate ownership models are clear. We will also have talked with some potential customers to get them thinking about being part of a community energy system and to see if we are likely to be successful at attracting customers. This is a stage of community confidence building and of learning about community energy options.

Stage 3 is the home stretch. We might either do more investigations, marketing and business model development for the community to proceed themselves or we develop a process for finding and selecting a private partner. Our last four projects have gone this route. This work is also done on a 50% basis with promise to pay the balance upon successful project financing. Once the project is well defined, we typically see the municipal utility taking responsibility for the distribution piping and for getting customers signed up. Expressions of interest are issued to seek private partners for the construction and operation of the supply system to supply heating, cooling and/or electricity on a long-term basis. Based on responses and on the municipalities' view on who would make a good partner, detailed proposals are requested from a short list as a basis for final negotiation of a partnership. Not all private developers like this approach − but enough to make it work.

By this summer, we expect to have over $140 million worth of projects constructed or

announced – almost all as public-private partnerships. Why is this working? There area number of reasons:

The community is only committing to explore options – not to building any, or all, of the ultimate project;
The process ensures that the community makes a commitment, after receiving free preliminary opinions. This makes them a stakeholder;
Potential customers are often comfortable discussing participation when they see that the objective is community benefit;
As the project develops, perceived risk decreases and private interests become more comfortable with a partnership;
The public becomes more comfortable with a municipal utility role as the community benefits are better articulated. Projects that we are involved in **all** have large public or environmental benefits;
The public also appears to be more comfortable with a public/private partnership than with giving a franchise or regulated monopoly to a private developer;
Work is subcontracted to the maximum level possible thus building local buy-in and experience in community energy project development;
The private partners is brought in when the risk is lower and public investment secured at a level that gives them a reasonable return on their investment.

From the federal government's perspective, investments in successful projects are repaid and the monies used to support other community developments. We hope to expand this program to a full-scale revolving fund to support more projects, engage some more staff but also to train and contract out more of the work.

My intent in outlining our development process was not to give a lecture on a program but to reinforce my message that projects are possible if we can constructively engage the community as an investor with different investment criteria. CHP and community energy systems networks have enormous public benefit at the local, state and national levels and constitute a very large investment opportunity for the private sector. It is in both the public and the private interest to assure that projects move ahead.

Before wrapping up, you might be interested in how CHP is also a solution for the transport industry. The average efficiency of the transportation sector is about 10 – 15%. Everyone is working on new liquid fuels and more efficient engines. But that doesn't address the main problem. The power plant is in the wrong place!

If we could maximize the electrification of the transportation industry – subways, streetcars, metros, light rail and ultimately E.V.'s – we could then have a stationary CHP plant where heat is used, emissions are better controlled and fuel flexibility is possible. And most importantly, the overall efficiency could be increased to over 80%.

I the short term, it may take all of your innovation, skill and deal making to pull of projects. However, I am sure, that like some many countries around the world, CHP and community energy systems will become an obvious solution of the United States as well

and policies and programs will follow.

In conclusion, I suggest that you consider several key things:

Remember that the broad introduction of CHP will be a disruptive technology. It will cause great difficulty for the status quo even though the long term benefits are great. Therefore, recognize the problems of transition and try to generate solutions – to help those in government and elsewhere with good advice.

Try to modify existing priorities that may lead to sub-optimum solutions, for example:

Distributed generation will be limited by the efficiency of electrical production, say 55% at best. Redirect this effort to distributed CHP and locate new generation so that heat can be sold;

District energy is a necessary partner for broad application of CHP. Make sure that CHP is the prime energy source for district energy where demands can not be supplied with waste renewable energy (e.g. landfill gas), waste heat from industry, or new renewable energy (e.g. wood chips);

Advanced power generation cycles can all be improved by operation in a CHP mode.

Challenge policy makers to consider measures similar to the Danish Heat Plan whereby new electricity generation permits will not be given if heat is not sold. Alternatively, require a seasonal efficiency of 65% or 70% for new generation.

CHP is the right way to go and needs all of your efforts to see that it contributes to national objectives to its full potential.